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ABSTRACT

As the latest in a series of studies analyzing the data reported on Tennessee's school district report cards, this paper focuses on finding a common statistical treatment to examine the impact of predictor variables on dependent variables. Investigations of the 1988-89 report card data explored the relationships among eight school district variables and the relationship between each variable and the average student test scores at the school district level. In 1990-91, Tennessee began using the Tennessee Comprehensive Assessment Program (TCAP) outcome measures, making comparisons of current data with the 1988-89 data impossible. The following four statistical treatments were compared for their usefulness in analyzing the data: (1) Pearson product moment correlation; (2) Guttman's partial correlation; (3) stepwise regression; and (4) multiple regression. Independent variables do not have the same impact on student outcome at all outcome levels using the four methods, and it was evident that choice of method has an impact on study conclusions. The contribution of each variable is considered. Four tables in the text and eight presented as appendixes present analysis results. (Contains 9 references.) (SLD)

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A STUDY OF VARIOUS STATISTICAL ANALYSES APPLIED TO SCHOOL REPORT CARDS

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A STUDY OF VARIOUS STATISTICAL ANALYSES APPLIED TO SCHOOL REPORT CARDS

I. INTRODUCTION

This paper represents the latest in a series of studies analyzing the data reported on Tennessee's school district report cards. Previous reports focusing on 1988-89 and 1990-91 report card data have been presented at this meeting (1991, 1992), at the annual conference of the American Association of School Administrators (1992,1993), at the American Educational Research Association (1992,1993) and at several other meetings (see References).

The investigations of 1988-89 report card data explored the relationships among eight school district variables (average attendance, average professional salaries, county per capita income, expenditure per student, average daily membership, percentage of oversized classes, percentage of students on free or reduced lunches, and percentage of educators on upper Career Ladder levels II and III) and the relationship between each variable and average student test scores at the school district level. In 1990-91, Tennessee began use of its new Tennessee Comprehensive Assessment Program (TCAP), thereby creating a new set of student outcome measures. This change made possible interesting extensions of the 1988-89 report card studies, yet it made comparisons of certain findings in the two sets of studies impossible.

The TCAP results were reported in greater detail in the 1990-91 report cards than in earlier report cards. Besides reporting more outcome measures, the 1990-91 and subsequent report cards report TCAP results on substantially more grade levels within school districts (2-8,10). This expanded reporting makes it possible to study the relationships among school district characteristics and student outcomes at different school levels (elementary, middle, secondary, and school system).

1 This paper includes some material presented at the annual meetings of MSERA (11/92), SRCEA (11/92), AASA (2/93,), and AERA (4/93) and extends the data analyses to produce several interesting new findings.

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In addition, the 1990-91 and subsequent report cards have added information about more school district/community variables than were available before that time. This paper contains analyses involving 15 rather than 8 variables. The seven added variables include number of schools in the district, percentage of enrollment change, percentage of regular diplomas awarded, percentage of honors diplomas awarded, percentage of vocational students, percentage of special education students, and percentage of Chapter I students.

In the conclusions of the above listed studies, the authors noted that the dependent variables should be organized and grouped. Also, the researchers observed that the statistical analysis chosen for the research project might have a substantial impact on the conclusions for the study. When reviewing the June, 1993 Educational Resources Information Center (ERIC) data base (1966 to June 1993), the authors noted that various statistical treatments were used to evaluate different independent variables. "Predictor Variables" is the term chosen by ERIC as a "Major Descriptor" to identify the independent variable(s). There were 377 citations in which the **Pearson Product Moment** Correlation statistic was used to evaluate the predictor variables, 429 citations using **Multiple Regression**, 53 citations using **Stepwise Regression**, and 8 citations using **Partial Correlation** (Guttman's). There was no single statistical treatment commonly endorsed by educational researchers to examine the impact that the predictor variable had on the dependent variable; rather researchers selected one or more procedures which the data, design, etc. seemed to dictate. It is this lack of common analysis procedure that is under investigation in the current study.

II. PURPOSE

This study's first purpose was to organize and group the independent variables from the Tennessee Report cards, 1990-91. The second purpose of this study was to determine how use of four different statistical (correlational) treatments [*i.e., (1) Pearson Product Moment, (2) Guttman's Partial Correlation, (3) Stepwise Regression, and (4) Multiple Regression*] might affect the study's conclusions. The third purpose of the study was to examine the impact the four statistical treatments had on student outcomes at four levels: (1) Elementary Outcome Level (EOL), grades 1-5; (2) Middle Outcome Level (MOL), grades 6-8; (3) High school Outcome Level (HOL), grades 9-10; and (4) System Outcome Level (SOL), grades 1-10.

III. TENNESSEE REPORT CARD (SAMPLE), 1990-91

Tables 1 and 2 present a 1990-91 report card. These figures are essential to the reader's understanding of what was and was not available to the researchers as a database. They also provide graphic representations of Tennessee's report cards as they have appeared since the mid-1980s.

IV. METHODOLOGY

The 1990-91 report cards provided test results for grades 2 through 10. The investigators conducted analyses at the school system/district level, school level and individual grade levels. Data were organized at four levels: elementary (grades 2-5), middle school (grades 6-8), high school (9-10), and system-level (grades 2-10).

Mean student outcomes were created for each level first by combining TCAP data for the grades within that level, then converting the reported scores to Z scores and computing their means. For the high school level, the mean student outcomes was created by combining 10th grade TCAP data with the scores reported for the 9th grade Tennessee Proficiency Test (TPT). These mean student outcomes were treated as dependent variables, as in the earlier studies. The 15 school district characteristics studied were treated as independent variables that influence student outcomes. To guide the study, three research questions were developed:

1. When the Factor Analysis statistic is applied to the Tennessee school district report card items, what can be learned regarding their similarities, weights, and complexity?

2. What impact does each of the four statistical treatments have on the study's conclusions?

3. Do different statistical treatments affect the study's conclusions?

Twenty school district characteristics were actually reported in the 1990-91 report cards. The investigators first evaluated all characteristics to determine their value as independent variables. The Kaiser test of Variable Sampling Adequacy was applied to each of the 20 report card items (independent variables) for the purpose of eliminating variables. Variables having a low index of matrix sampling adequacy (MSA)($\leq$.500) were eliminated for further study because they do not belong to the same low psychometric

Table 1. Testing Information For Widget City Schools Too (1990-91 Report Card Data).

Widget Too Schools

TENNESSEE COMPREHENSIVE ASSESSMENT PROGRAM (TCAP)

Reading

GRADE								
Year	2	3	4	5	6	7	8	10
State Avg.	na	na	na	na	na	na	na	na
1990-91	7	6	6	6	6	7	7	6

Language

GRADE								
Year	2	3	4	5	6	7	8	10
State Avg.	na	na	na	na	na	na	na	na
1990-91	7	6	6	6	6	6	7	6

Math

GRADE								
Year	2	3	4	5	6	7	8	10
State Avg.	na	na	na	na	na	na	na	na
1990-91	7	7	7	6	6	7	7	7

Science

GRADE								
Year	2	3	4	5	6	7	8	10
State Avg.	na	na	na	na	na	na	na	na
1990-91	7	6	7	6	6	7	6	6

Social Studies

GRADE								
Year	2	3	4	5	6	7	8	10
State Avg.	na	na	na	na	na	na	na	na
1990-91	7	6	7	6	6	6	6	6

TENNESSEE PROFICIENCY TEST (TPT)

Language

Grade 9

Year	With Special Ed.	Without Special Ed.
State Avg.	na	na
1990-91	90	91

Mathematics

Year	With Special Ed.	Without Special Ed.
State Avg.		na
1990-91	98	98

Both

Year	With Special Ed.	Without Special Ed.
State Avg.		na
1990-91	88	90

Testing Information

Students in Tennessee are given two types of tests.

Students were introduced this spring to the **Tennessee Comprehensive Assessment Program (TCAP).** This program mandates a customized, norm referenced and criterion referenced test for grades 2 through 8, a norm referenced test for grade 10, and the **Tennessee Proficiency Test.**

The customized test will allow each teacher to assess progress of students during the school year with a minimum amount of testing time. The program will generate consistent types of test scores from grade to grade. The norm referenced data will allow longitudinal status of individual, school, system, and state growth in order to evaluate and improve programs and curricula. The criterion referenced data will report the mastery , partial mastery, and non-mastery of tested domains for each school year. Although the objectives for the Tennessee Proficiency Test has been updated, the rules and regulations governing the test will remain the same.

The Tennessee Proficiency Test measures minimum skills in mathematics and language arts. Students must achieve a passing score of 70 percent correct on both the math and language arts tests in order to fulfill one of the requirements for receiving a regular diploma. Students take the test for the first time in the ninth grade.

Table 2. System Information for Widget City Schools Too (1990-91 report card data).

Widget Too

System Information		Grade Level	1988-89	1989-90	1990-91	State Average
Number of Schools		K-12	5	5	5	na
Average Daily Membership		K-12	3,372	3,9290	3,436	na
% Student Attendance		K-12	95.1	95.8	95.6	na
% Enrollment Change		9-12	-15.2	-12.1	-20.1	na
%Oversized Classes		K-12	2.3	1.4	1.5	na
% of Students on Free or Reduced Lunches		K-12	21.0	22.0	23.0	na
Expenditure per Pupil		K-12	$3,501	$3,942	$4,073	na
County Per Capita Income		K-12	$12,819	$13,662	$14,192	na
% Elementary Schools Accredited by SACS		K-8	100	100	100	na
% Secondary Schools Accredited by SACS		7-12	100	100	100	na
Professional Educator Information						
% Professionals on Career Ladder II and III		K-12	25.6	28.6	30.8	na
Average Professional Salary		K-12	$30,804.37	$31,590.60	$33,753.00	na
Student Information						
% Diplomas Granted	Regular	12	75.8	73.4	79.5	na
	Honors	12	20.0	22.0	18.6	na
	Special Education	12	1.5	0.9	1.0	na
	Certificate of Attendance	12		.09		na
	Seniors not Receiving Diploma in Spring Graduation	12	2.7	2.8	1.0	na
% Students in Vocational Education Courses		7-12	41.0	41.3	39.3	na
% Students in Special Education		K-12	12.1	12.6	13.6	na
% Chapter 1 Students		K-12	12.1	12.6	8.7	na

Other Information:

Percent of Student in Attendance (%SA). This figure shows the average percent of student in attendance daily in your school system for the 1990 91 year.

Percent Enrollment Change (%EC). This figure shows the percent change in a group of student who started in the ninth grade four years ago and should have completed the twelfth grade this year. It is a four year average. Decreases happen when students drop out of a school, move away, graduate early, fail a year, or leave school for other reasons not listed.

Percent of Oversized Classes (%OC). This figure shows the percent of classes in all grade levels which had waivers for being over the maximum class size. Maximum class sizes in Tennessee are 25 for grades K-3; 28 for grade 4, 30 for grades 5-6; 35 for grades 7-12; 23 for vocation.

Percent Students on Free or Reduced Lunches (%FRL): Students whose family income meets certain criteria are eligible for free or reduced price lunches. This figure shows the percent of student sin your school system who receive free or reduced price lunches.

Expenditure per Pupil (EPP). This figure shows the average number of dollars spent for each pupil in average daily attendance for your school system.

County Per Capita Income(CCI): This figure represents the per capita personal income for the county in which your school system is located. The most recent figures available from the U.S. Bureau of Economic Analysis are for 1988.

Percent Elementary/Secondary Schools Accredited by SACS (%ES): Schools may elect to seek accreditation from the Souther Association of College and Schools (SACS) in addition to receiving state approval. This agency recognizes quality schools, maintains a list of accredited schools and requires a continuing school improvement program.

Percent Professionals on Career Ladder Levels II and III (%CL): This figure show the percent of professional staff in your school system who have met the standards for Career Levels II and III. These are the upper rungs of Tennessee's Career Ladder program. The number includes regular classroom teachers, guidance counselors, libranans, and administrators.

Average Professional Salary (APS): This figure shows the estimated average salary for all certificated personnel in your school system.

Diplomas Granted: These figures show the percent of the twelfth grade class receiving different types of diplomas. Some school systems have requirement that may exceed these standards. Tennessee students may receive four kinds of diplomas:

High School Diploma (D-HS): Awarded to students who (a) earn 20 units of credit, (b) make passing scores on all components of the Proficiency Test and (c) are satisfactory records of attendance and conduct.

Honors Diploma (D-HO): School systems may offer an optional diploma to students who meet increased requirements established by the State Board of Education. The requirements include accelerated English, math, science and social students, and a 3.0 grade point average.

Special Education Diploma (D-SE): Awarded to students who have satisfactorily completed an individualized Education Program and who have satisfactory records of attendance and conduct, but who have not passed all components of the Proficiency Test.

Certificate of Attendance (D-CA): Awarded to students who have earned 20 units of credit and who have satisfactory records of attendance and conduct, but who fail to meet Proficiency Test standards.

Students Not Receiving Diploma in Spring Graduation (D-NR): This figure represents students who will receive their diplomas after completing summer school or who failed to complete high school.

Percent of Students in Vocational Education Courses (%VO): This figure shows the percent of the school system's average daily membership enrolled in one or more vocational education courses. Students enrolled in more than one vocational courses are counted only once.

Percent of Students in Special Education (%SE): This figure show the percent of students in your school system who are receiving special education services.

Percent of Chapter 1 Students (%CH1): Chapter 1 is a federally funded program to assist students in the areas of reading and mathematics. This figure shows the percent of student receiving services under Chapter 1.

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content as the other variables in the composite of variables. Five characteristics were eliminated (e.g., the item with the smallest MSA was eliminated, then the Kaiser's was used to re-analyze the collective MSA for the remaining items. This process was repeated until the total MSA was larger than 0.50.) from the study were: *percent elementary schools accredited by SACS, percent high schools accredited SACS, diplomas granted in special education, certificates of attendance granted as diplomas,* and *seniors not receiving diplomas in spring graduation.* Appendix A presents the results of this analysis. The Kaiser's test of Variable Sampling Adequacy was finally computed (see Appendix B). Now, the MSA was greater than .50 for each of the four grade levels.

To answer research **question 1**, the Kaiser test Variable Sampling Adequacy was used to evaluate the outcome level with each of the 15 independent variables. The Bartlett Test of Sphericity was used to examine the probability of each outcome level and the inclusion of the 15 variables into the model. Next, Default Method of the Principal Component Analysis, Orthogonal Transformation Solution-Varimax was used to organize and group the independent variables into Factors. The Proportionate Variance Contributions was developed to examine the percentage of variance for each factor and for the four outcome levels. Finally, the Variable Complexity-Orthotran-Varimax was used to examine the complexity of each of the 15 independent variables.

In response to research **question 2**, the (1) Pearson Product Moment Correlation statistic, (2) Guttman's Partial Correlation statistic, (3) Stepwise Regression statistic, and the (4) Multiple Regression statistic were used to evaluate the impact the independent variables had on student outcome (i.e, EOL, MOL, HOL, and SOL data).

Question 3 was used as a means of focusing conclusions and implications. Report cards on schools and the data included in them generate policy discussions. The findings of this study, when added to those of the earlier studies, should be useful to policymakers at all levels.

V. FINDINGS

1. When the Factor Analysis statistic is applied to the Tennessee school district report card items, what can be learned regarding their similarities, weights, and complexity?

The Kaiser test of Variable Sampling Adequacy was used to eliminate the Tennessee Report Card items that did not belong to the same low psychometric content

as the other variables in the composite of variables. The matrix sampling adequacy (MSA) for the four outcome levels indicated that EOL was .57, MOL was .58, HOL was .57, and SOL was .58 (see Appendix B). The two items with a low MSA were EPP and %VO, but because the acceptable MSA for all 15 variables were all larger than .50, the researchers elected to include them as part of the study (see Table 2 for list of 15 independent variables and related acronyms). The Bartlett Test of Sphericity indicated a significant difference ($p \leq .01$) between each of the outcome levels.

A. Similarities between Outcome Levels

The *Principle Component Analysis, Default Method, Orthogonal Transformation Solution-Varimax* was used to examine and organize the report card items. As Appendix C illustrates, when factor analysis was used to group the TN report card items by factors, the analysis indicated that there were six factors in each of the four outcome levels.

Report card items identified three or more times between the four outcome levels are examined. The four outcome levels were compared by Factors: Factor 1 reflected a relationship between a positive student outcome and a negative %FRL, and %CH1; Factor 2 reflected a relationship between a positive #SCH and ADM and a negative %SE; and Factor 3 reflected a negative D-HS and a positive D-HO. Factor 4 is a single-item factor since only %OC was common to three of the four outcome levels. Factor 5 and Factor 6 reflected no common items between outcome levels.

Different report card items are joined differently by both factor and outcome level. For example, when EOL factor analysis was used to examine Factor 1, a positive EPP, %CL, and APS were joined with the outcome level and a negative %CH1 and %FRL; at the MOL and HOL, %SA and %EC were identified and grouped as part of Factor 1; but at the EOL and SOL, %CL and APS were identified. There seem to be as many or more differences between outcome levels and factors than there are similarities. Factor 2 and Factor 3 identify the same report card items for each of the four outcome levels, but in Factor 4, CCI is identified in EOL, but not in MOL, HOL, and SOL. Factors 5 and Factor 6 reflect many of the inconsistencies observed in the identification and organization of items and related factors.

Therefore, labeling a specific factor with a term or group of terms by combining similar items and then grouping them into one factor is a difficult task, especially with the inconsistencies noted between the different outcome levels.

B. Each Factor's Weight

The *Proportionate Variance Contributions (Orthogonal)-Varimax* was developed for each of the six Factors for each of the four different outcome levels (see Appendix D). Generally, Factor 1 accounts for a larger percentage of variance than the other five factors. Factor 2 produces more variance than factors 3-6. Factors 5 and 6 produce about half as much variance as Factor 1 or Factor 2.

C. Complexity of each of the 15 report card items.

The *Variable Complexity-Orthotran/Varimax* (see Appendix D) was used to measure the complexity for each of the four outcome levels and their respective 15 independent variables. The larger the number generated, the more complex the item. "Complexity" might be explained as an numeric indicator representing number of independent variables that might impact the dependent variable. For instance, EPP might reflect the SES of the community, local tax rate, school district's emphasis on teacher education, etc. Since the *Variable Complexity-Orthotran/Varimax* is a parametric statistical treatment that is used to analyze "interval" data, the assumption of additivity can be applied to the resulting data analysis (i.e., complexity: 1+1+1=3).

At the EOL and MOL, EPP (3.7, 2.9, respectively), %SE (3.7, 3.6, respectively), %FRL (3.0, 3.2, respectively), and %CH1 (2.7, 3.3, respectively) are the most complex items. At the HOL, %CL (3.1), %SE (3.0), and APS (2.6) appear to be the most complex. Items identified as complex in HOL were different from the items identified in EOL and MOL. The six items with the least complexity are ADM (1.0), #SCH (1.1),%VO (1.1), D-HS (1.1), %EC (1.2), and %OC (1.2). Items identified as more complex are approximately three times more complex than the items that are not identified as complex. The average complexity of the items at each of the outcome levels is 1.7 to 1.8. Finally, the items at the SOL were very similar to both the EOL and MOL; EPP (3.7), %SE (3.7), and %FRL (2.8) were the most complex variables in the Variable Complexity-Orthotran/Varimax Factor Analysis.

2. What impact does each of the four statistical treatments have on the study's conclusions?

Student outcome is examined from four perspectives: elementary outcome level, middle school outcome level, high school outcome level, and system outcome level.

Next, four different statistical treatments were used to analyze the Tennessee School District Report card data including: (1) Pearson Product Moment correlation, (2) Guttman's Partial correlation, (3) Stepwise Regression, and (4) Multiple Regression . Comparisons were made between the four statistical treatments at each of the four outcome levels.

A. Pearson Product Moment Correlation

The Pearson Product Moment Correlation was used to examine the relationship between the 15 Tennessee report card items and student outcome at each of the four outcome levels (see Appendix E). Next, Appendix F was developed to illustrate the relationships between student outcome at each of the four outcome levels with the 15 report card variables. As Appendix F illustrates, %FRL, %CH1, and APS have the largest impact (greater than 15%) on student outcome from all four outcome perspectives. In addition, %SA has a large impact at the HOL and SOL, and a moderately large impact at the EOL and MOL. There is a strong relationship between %CL at the EOL, MOL, and SOL, and a moderately large impact at the HOL. There was a large relationship between EPP and MOL, but a moderately large relation at the EOL, HOL, and SOL. Items reflecting a small (less than 3%) impact on student outcome included #SCH, ADM, CCI, D-HS, D-SE, %VO, and %SE--seven of the 15 TN report card items.

When the percentages of influence were collectively examined ("r" converted to "r^2") and variances between the independent and dependent variables were calculated by by outcome level, an interesting phenomenon was observed. At the EOL, the 15 items accounted for 135% of the variance between the independent variables and the dependent variable. At the MOL the 15 items represented 142%; at the HOL they represented 137%; and at the SOL they represented 168%. Anything over 100% suggests that the analysis is flawed or something else is incorrect; *after the cup becomes full, there is a lot of water spilt on the table.* Contrary to the evidence reflected by the numerous ERIC citations, is it possible that the PPM is an inappropriate and flawed statistical treatment when it is used to examine the true impact between a number ($n \geq 2$) of independent variables and the dependent variable because it does not take into account the overlap between the independent variables, and therefore, yields misleading results?

B. Guttman's Partial Correlation

Next, the Guttman's Partial correlation was used to examine the impact each of the 15 report card variables had on student outcome (see Appendix G). At the EOL, the analysis suggested that EPP, %FRL, and %SA had a moderately large (5-14%) impact on student outcome; EPP, %CH, and %SA had a moderately large impact at the MOL; %SA and ADM at the HOL; and %SA, EPP, and %CH1 at the SOL level. The items with a small (1-4%) impact at the EOL included %OC, %CL, %CH1, %SE, D-HO, and APS; %CL, %OC, %FRL, D-HS, D-HO, and %VO had a small impact at the MOL; %VO, #SCH, %EC, and APS at the HOL; and finally, %OC, %CL, %VO, %EC, D-HS and ADM had a small impact at the SOL. Note that six items were omitted at the EOL and MOL, eight at the HOL, and five at the SOL.

When the items having one percent or more influence were summed by outcome level, they represented **38%** at the EOL, **34%** at the MOL, **39%** at the HOL, and **47%** at the SOL. When items having less than one percent were added to the mix, the additional items increased the percentage of influence by less than two percent.

C. Stepwise Regression.

Using a .05 level of significance, the Stepwise Regression (SR)-Forward statistic was used to analyze the TN report card data (see Appendix G). At the EOL, %FRL, EPP, and %SA accounted for 49% of the variance between the dependent variable (student outcome) and the independent variables; at the MOL, APS, %SA, ADM, %CH1, and EPP accounted for 58%; at the HOL, %CH1, %SA, and APS accounted for 48%; and at the SOL, %FRL, EPP, %SA, %CH1, and ADM accounted for 62% of the variance. Note that 12 items were not identified at the EOL, 10 at the MOL, 12 at the HOL, and 10 at the SOL.

D. Multiple Regression.

The Multiple Regression (MR) was used to examine the report card data (see Appendix G) from 91 of the 120 districts: 29 districts provided incomplete data for all of the 15 report card categories. The MR statistic is the study's single statistic that does not attempt to identify and analyze the particular items in the analysis, but examines them from a "total" perspective. The multiple regression model suggested that the study's independent variables "collectively" were significant at all of the the four outcome levels (.0001, .0001, .0001, .0001, respectively). When used to examine the impact the 15

variables had on student outcome, the adjusted R^2 accounted for 49% at the EOL, 58% at the MOL, 49% at the HOL, and 64% at the SOL. The adjusted R^2 was generally 8% lower than the R^2.

Although intercept for the four outcome models suggested a strongly significant ($p \leq .014$, .119, .001, and .00001, respectively) impact on student outcome at each of the four outcome levels, the individual variables impacted outcome varied between the four outcome levels. The %SA, %FRL, and EPP items reflected a significantly important impact on outcome at the EOL, the %SA, EPP, and %CH1 at the MOL, the ADM and %SA at the HOL, and the %SA, EPP, and %CH1 at the SOL: the %SA category is the single category that impacts student outcome at each of the four outcome levels.

E. The percentage of variance was compared with the Pearson Product Moment correlation, Guttman's Partial Correlation, and Stepwise Regression along with the probability of the Multiple Regression.

Do different statistical analyses produce different conclusions? When the Pearson Product Moment (PPM), Guttman's Partial Correlation (GPC), Stepwise Regression (Forward), and the Multiple Regression (MR) statistical analyses were compared to each other (see Appendix G), the statistical analysis suggested different conclusions.

The PPM analysis suggested that **%FRL** had a large impact (26%, 24%, 28%, 33%, respectively) on outcome at all outcome levels; the GPC analysis reflected a *small* impact (7%, 2%, 0%, and 5% respectively), and the SR suggested a *large to no* impact (25%, 0%, 0%, and 32%, respectively) on student outcome. When the **APS** was compared between the three statistical analyses, the PPM suggested a large impact (19%, 28%, 19%, 27%, respectively), the GPC analysis reflected a very small impact (1%, 0%, 3%, 0%, respectively), and the SR did not identify this report card item as having a significant effect on outcome. When **%CH1** was compared among statistical treatments, the PPM analysis reflected a strong influence on outcome (21%, 26%, 30%, and 31%, respectively), the GPC analysis suggested a moderately weak impact (2%, 6%, 5%, and 7%, respectively), and the SR suggested a large impact at the HOL, a minor impact at the MOL and SOL, and no impact at the EOL.

The summary table below (Table 3) compares the items that were identified in each of the four statistical treatments as having an important/significant impact on student outcome. When the four statistical treatments are compared at each of the four outcome levels, no one single report card item was identified by all four statistical treatments at all

of the four outcome levels. Note that %SA is single category identified by all four statistical analysis at the **EOL, HOL, and SOL**, CH1 at the **MOL and SOL**, EPP at the **MOL**, and %FRL at the **EOL**.

Table 3. The Pearson Product Moment (PPM), Guttman's Partial correlation (GPC), and Stepwise Regression (SR) are used to compare seven items that are strongly identified in the analysis at each of the four different outcome levels.

	Elementary Outcome Level (EOL)	**Middle Outcome Level (MOL)**	**High school Outcome Level (HOL)**	**System Outcome Level (SOL)**
1. %SA	PPM, GPC, SR, MR	GPC, SR, MR	PPM, GPC, SR, MR	PPM, GPC, SR, MR
2. %CH1	PPM	PPM, GPC, SR, MR	PPM, GPC, SR	PPM, GPC, SR, MR
3. EPP	GPC, SR, MR	PPM, GPC, SR, MR	--	GPC, SR, MR
4. %FRL	PPM, GPC, SR, MR	PPM	PPM	PPM, GPC, SR
5. APS	PPM	PPM, GPC	PPM, GPC	PPM
6. ADM	--	GPC	SR, MR	PPM
7. %CL	PPM	PPM, SR	--	PPM

While Table 3 illustrates the differences between statistical techniques, Table 4 illustrates the variance (the percentage common to the individual independent variable and the dependent variable) between variables. Although the MR statistic can not be used to compare the percentage of variance between variables, it can be use to illustrate the probability that independent variable has on the dependent variable. When the independent variables with the most impact on outcome are re-examined, note that the PPM generally reflected the largest impact on the dependent variable, the GPC statistic identified the second most variables, but generally reflecting small impacts on the dependent variable, and the SR identifying the fewest variables. The MR statistic that reports probability instead of the percentage of variance between the variables, identified two to three independent variables which is fewer times than either the PPM, GPC or the SR analysis. The %SA item is the only independent variable identified by all four (PPM, GPC, SR, or MR) statistical techniques.

Table 4. The percentage of variance (%) between the independent variables and student outcome at four outcome levels (Elementary, Middle, High, & System) are compared by the Pearson Product Moment (PMM), Guttman's Partial Correlation (GPC), and Stepwise Regression (Forward) (SR) and the Multiple Regression (MR) Sums of Squares Model Coefficient (Type III) was used to examine the probability for each report card category.

	Elementary				Middle				High				System			
	Pearson Product Moment	Partial Correlation	Stepwise Regression	Multiple Regression	Pearson Product Moment	Partial Correlation	Stepwise Regression	Multiple Regression	Pearson Product Moment	Partial Correlation	Stepwise Regression	Multiple Regression	Pearson Product Moment	Partial Correlation	Stepwise Regression	Multiple Regression
	%	%	%p≤.05		%	%	%p≤.05		%	%	%p≤.05		%	%	%	p≤.05
1. %SA	15	7	7	.02	12	6	13	.03	21	14	13	.00	20	13	5	.00
2. %CH1	20	2	•	•	26	6	6	•	30	5	29	•	31	7	2	.03
3. EPP	12	11	16	.01	16	8	4	.01	4	•	•	•	13	9	22	.01
4. % FRL	26	7	25	.02	24	2	•	•	28	•	•	•	33	5	32	•
5. APS	19	1	•	•	28	•	27	•	19	3	6	•	27	•	•	•
6. ADM	2	1	•	•	1	•	7	•	1	5	•	.05	2	1	2	•
7. %CL	16	3	•	•	17	5	•	•	10	•	•	•	18	3	•	•

When the percentage of variance between the independent variables were the dependent variable (outcome) is compared among the four statistical treatments (see Appendix G), the **Pearson Product Moment** correlation "over" inflated (*i.e., between 135% to 168%*) the impact between the dependent variable (student outcome) and the independent variables. When the remaining three statistical treatments are compared, the **Multiple Regression** statistic computed the largest (*49% to 64%*) percentage of impact between the independent variables and the dependent variable, **Stepwise**

Regression analysis strongly paralleled the Multiple Regression analysis (*48% to 62%*), and the **Guttman's Partial Correlation** statistic reflected the smallest (*36% to 48%*) impact between the independent variables and student outcome. When the ranges of student impact were examined for the four statistical treatments and each of the four outcome levels, it reflected a 10-22% difference among the independent variables and student outcome.

VI. CONCLUSIONS

Question 3. What are some of the important considerations when designing a state report card?

The primary focus of this paper is to examine, collectively, the statistical treatments and their differing results when applied to report card data. Below is a discussion of the: (A) each variable's importance by outcome level, (B) variable complexity, (C) impact a statistical treatment has on the study's conclusions, and (D) important and unimportant variables.

A. Independent variables do not have the same impact on student outcome at the four outcome levels (elementary, middle, high school, and system) using any of the four types of statistical analyses.

The independent variables do not have the same impact on the dependent variable at each of the four outcome levels. The Tennessee School District Report cards make no provision for interpreting the data at each of the four outcome levels. In addition, the report card items are generally grouped into different factors at each of the four outcome levels. At one level the item might imply one factor (see Appendix C) while at another level, the item might align with another factor. Also, note that while one factor might be large at one outcome level, it could have considerably more impact on student outcome at another level. It is the authors' opinion that before items are identified and reported in School District Report cards, a better understanding of the complexity of each of these items should be developed. As the Variable Complexity analysis illustrates (Appendix D), the percentage of students on free or reduced lunches seems to be a very complex variable at the elementary, middle, and system level (3.0, 3.2, and 2.8, respectively), but comparatively less complex at the high school level (1.1).

B. The complexities of the 15 independent variables vary greatly.

Before items are identified and reported in a school district report card, the state department of education should develop a better understanding of the complexity of each of these items reported. As the Variable Complexity analysis illustrates (Appendix D), percentage in Special Education, Free/Reduced Lunch, and Expenditure Per Pupil appear to be very complex independent variables. The percent Special Education seemed to be the most complex variable studied. This variable could be reflecting a variety of other sub-areas that might include parent's education, student's nutrition, differences in district's standards for being placed in the Special Education program, teachers/administrators academic expectations, and district's funding policy. In addition, its complexity could also reflect some of the Tennessee report card items such as #SCH, ADM, and CCI (r= -.24, -.27, and +.25, respectively)(see Appendix E).

The **%FRL** and **EPP** independent variables appear to be complex at the elementary, middle, and system levels, but relatively simple at the high school level. The **%FRL** variable could reflect the child's pre-school education, community's socio-economic level, the pride and self-esteem of the student and/or parent, or the student's drive and motivation. In addition, %FRL might relate to other report card items such as %Student Attendance, %Enrollment Change, %Career Ladder, Average Professional Salary, and %Chapter 1 (r= -.38, -.38, -.32, -.35, and +.69, respectively). The **EPP** independent variable could reflect a combination of variables such as state money, county funding, national grant money, and school board allocation of funds. Report card items that relate to EPP might include #Schools, Average Daily Membership, Average Professional Salary, and %Vocational education.

The %CL and APS are complex at the high school level. The **%CL** item could be reflecting the teacher's postsecondary training, the teacher's academic expectations, the teacher's motivation and drive, plus some report card items such as %FRL, APS, %VO, and %CH1 (-.32, .50, .42, and -.33, respectively). Finally, when **APS** is examined, other factors may be involved, such as school district pay schedule, local tax base, local/state/national funds, plus some TN report card items including #SCH, ADM, %OC, %FRL, EPP, %CL, and D-HS (.41, .42, -.32, -.35, .73, .50, -.34, respectively).

Many items reported in the Tennessee school district report cards are not clearly defined, overlap other known items, and are not statistically discrete. Much more

understanding and insight needs to be developed by state and local educators before an item is finally included and reported in a state report card.

C. The researchers' selection of a particular statistical treatment has a large impact on the study's conclusions.

The statistical treatment chosen by the researchers appears to have a large impact on the study's conclusions. How often has the reader observed the Pearson Product Moment correlation as the primary statistical treatment for a research project? After the percentage of variance is calculated for the Pearson Product Moment, the findings appear very promising. For instance, at the Elementary Level, the %FRL, %CL, APS, and %CH1 represent 82% of the things that impact outcome (Appendix F). However, if all the variables are summed at this level, the total is more than 100% (135%). Yet, researchers might use this analysis to assert that these four items account for 82% of outcome. Using the data provided by the 1990-91 Tennessee School District Report cards and analyzing it with the Pearson Product Moment correlation, "there appears to be a lot of water spilt on the table after the cup is full."

D. EPP, %SA, APS, %FRL, and %CH1 have a relatively important impact on student outcome--10 other items in the report cards do not.

Below, the Tennessee Report card items that have the largest impact on student outcome at each of the four outcome levels are individually examined. Also, a general discussion regarding the 5 variables that were initially eliminated plus the 10 other independent variables are discussed.

The impact the independent variable had on student outcome is examined below using both the Guttman's Partial Correlation and Stepwise Regression statistical treatments. The Pearson Product Moment is not mentioned to any substantial degree because the authors believe the relationships are not true. Finally, since the Multiple Regression statistical treatment does not identify specific relationships between independent variables and the dependent variable, it is excluded from the discussion below.

1. **Items with a large impact on student outcome include EPP, %SA, APS, %FRL, and %CH1.**

a. **Percent Student Attendance (%SA)**

While the GPC statistical treatment suggested that **%SA** has a moderately low impact on student outcome (7%, 6%, 14%, and 13%, respectively), the SR statistic also indicated a comparable impact on student outcome at each of the four outcome levels (7%, 13%, 13%, and 5%, respectively). In addition, %SA was one of two Tennessee report card items that was identified by the PPM, GPC, and SR at three of the study's four outcome levels. However, %SA item did not have a consistent impact on student outcome with the GPC or the SR statistics, or at the four outcome levels.

b. **Percent Chapter 1 Students (%CH1)**

When applying the GPC statistical analysis to the district report card data, **%CH1** represented a small portion of the impact on student outcome across the four outcome levels (2%, 6%, 5%, and 7%). When the SR analysis was applied to the data, it did not have an impact on student outcome at the elementary level, but reflected a wide range of impact for the middle, high school and system levels (6%, 29%, and 2%, respectively). The MR statistic suggested that %CH1 had a significant impact at the elementary, middle school, and high school levels, but reflected no impact at the system level. The %CH1 was one of Tennessee school district categories (%SA is the other) where three statistical treatments--PPM, GPC, and SR-- suggested that %CH1 had an important impact on student outcome at three outcome levels (middle, high school and system, but not elementary).

c. **Expenditure per Pupil (EPP)**

The GPC data analysis suggested **EPP** had a moderate impact at the elementary, middle and system levels (11%, 8%, and 9%, respectively), but no impact at the high school level. The SR analysis reflected a wide range of impact on student outcome at the four outcome levels (25%, 4%, 0%, 15%, respectively). The Multiple Regression analysis indicated that EPP reflected a significant ($p \leq .01$) component for the regression model at the middle, high school and system levels, but not at the elementary level. Neither the PPM, GPC, nor the SR analyses suggested an important relationship

between EPP and student outcome at the high school level. The EPP did not have a consistent impact on student outcome at all outcome levels.

d. Percent Free-Reduced Lunch (%FRL)

The GPC analysis indicated that **%FRL** had little to no impact on student outcome at the four outcome levels (7%, 2%, 0%, 5%, respectively), while the SR analysis suggested that it had a large impact at the elementary and system levels (25%, 32%, respectively) but no impact at the middle or high school levels. Although the Multiple Regression model was strongly significant at all four outcome levels, %FRL (Type III Sums of Squares) suggested that it did not have a meaningful impact at the middle, high school, or system levels, but did at the elementary level. The %FRL was identified by three statistical treatments----PPM, SR, MR--at the elementary and system levels, but only by the PPM at the middle and high school levels. The impact that %FRL had on student outcome varied greatly (0% to 32%), and suggested that both the selection of a statistical treatment and/or the school level evaluated had a major impact on whether or not %FRL is an important indicator of student outcome.

e. Average Professional Salary (APS)

The GPC statistical treatment indicated that **APS** did not impact outcome at the elementary, middle, or system levels, but indicated that it had a small (3%) impact on student outcome at the high school level. The SR analysis indicated that APS did not have an important impact on student outcome at the elementary or the system levels, but accounted for 27% of the things that impacted student outcome at the middle level and 7% at the high school level. The PPM analysis indicated that APS had a large impact at all four outcome levels. The APS's impact varies greatly depending on the statistical treatments used and at the respective outcome levels examined.

f. Average Daily Membership (ADM) and Percent Career Ladder II and III (%CL)

The ADM and %CL are marginally important as a contributor to student outcome in the PPM and GPC statistical treatments, but not verified by the SR or the MR treatments. Should an educator consider the issue of district size (ADM) or the underlying factors that contribute to a teacher's advancement to Career Ladder II or III (%CL)? Some factors that might impact upper %CL status include the teachers' or administrators' advanced

education degrees or training, their perceptions and evaluations of the educator being evaluated, or some collection of "portfolio" materials. If these are important, they are marginally important at the elementary and middle school levels ($p \leq .112$, .053, respectively [see appendix G-Multiple Regression]), but not at the high school or system levels.

2. **Fifteen of the 20 Tennessee school district report card items either cannot be accurately measured with the available data, or do not have a strong impact on student outcome.**

At the beginning of the study, because insufficient data were reported on the 1990-91 school district report cards (i.e., many districts elected not to report all district data to the state) or because the Kaiser's MSA guidelines were not met (see Appendix A), the researchers eliminated 5 items from the pool of 20. At the end of the study, after the impact on student outcome of each of the remaining 15 items were computed, the researchers noted that 10 of the remaining 15 Tennessee school district report card items had little to no impact on student outcome.

VII. A DISCUSSION

Of the 20 items currently reported in the Tennessee report cards, 4 items have a marginal impact on student outcome (see Appendix H). Why have 16 of these items been continuously included in the report card format between 1985 and 1994? Several important questions could be asked to the developers and promoters of the current Tennessee Report Cards such as:

(1) Were some items included in current state report cards because the data represented available state demographic data, and not pertinent educational data?

(2) Were educational experts consulted prior to the development of the current report card format?

(3) To what extent was a thorough and exhaustive statistical analysis applied to the current list of items before they were used in the current school district report cards?

(4) Was a comprehensive review of the literature conducted prior to the development of the current report card format?

(5) To what extent were items selected on a basis of their impact on student outcome?

Earlier papers (Bobbett, 1992b, 1993 a and b) noted that by using System data and respective data analysis, the district represented in Tables 1-2 was the top school district in Tennessee. Could a school board member, state policy maker, parent, teacher, or administrator--with the current reporting format and corresponding data analysis--differentiate between or identify excellent, average, moderately poor, or poor school districts? If the answer is "no", then why are the current items and respective data analysis still part of the Tennessee school district report cards?

Currently, only expenditure per pupil, percent of student attendance, percent of free and reduced lunch, and percent of Chapter 1 students had an important impact on student outcome. The data analysis further suggested that each of these items reflected varying degrees of importance between school levels (elementary, middle, and high school). Until educators identify and evaluate items that have a important impact on student outcome at both the school level and the individual grade level, how valid and reliable are the state's report cards?

Multicollinearity (*i.e., the "overlap" or common variances between different independent variables*) might have a large impact on the current report card items and the corresponding data analysis. For example, to what extent do *expenditure per pupil*, *percent of free and reduced lunch*, and *percent of Chapter 1* students relate to each other? The study's data analysis suggests that when the PPM analysis is compared to the study's other data analysis, the r^2s between the independent variables and the dependent variables vary greatly. If multicollinearity is not examined and addressed prior to the selection of the independent variables, then consumers of report cards and future researchers are left with the obstacle of separating the "wheat from the chaff". If items are selected without accounting for the multicollinearity aspect, is the respective data analysis valid and reliable? Educators need to examine each variable and ask the question, "how does this single variable relate to other identified variables?" For instance, if an independent variable strongly "overlaps" another independent variable(s), then maybe these two variables need to be further refined or re-examined.

Selection and application of a statistical treatment have a large impact on a study's conclusions. With any study, researchers should ask some additional probing questions such as:

(1) Were the data nominally distributed?

(2) Were other statistical assumptions ignored (i.e., homoscedasyicity, randomly selected, common variance, etc.)?

(3) To what extent did multicollinearity have on the data used in the study?

(4) Was Stepwise Regression (both Forward and Backward) applied to the data to confirm the Pearson Product Moment statistical treatment analysis?

(5) Were additional Multiple Regressions analysis applied to the same data to validate the observations noted in the earlier Stepwise Regression?

(6) Did outliers have a major impact on the data analysis? If they did, were these outlier's frequency, magnitude, or leverage examined?

(7) If Factor Analysis (FA) statistical treatment was applied to the study's data, did the authors examine the data from a single perspective using a single FA statistical treatment (i.e., the single treatment the researchers might have on their current PC statistical package), or, did they first use a variety of FA models and then select the model that best organized and explained the relationships between the different items grouped in each of the different factors?

Is the current educational research literature reflective of this type statistical reporting, where many of the above questions are never reported and discussed? The above list of questions represent only the tip of the iceberg, and does not represent the breath of the statistical treatments needed in our educational research. After examining this study's sample of a Tennessee's school district report card, does the current format suggest any evidence that suggests an exhaustive analysis of the report card data?

Finally, the researchers urge that consideration be given to collecting, analyzing, and reporting factors such as school organization, school culture, student motivation, parental involvement, instructional methodologies, ethic/moral norms (i.e., teen pregnancy, truancy trends, suspentions/expulsions, etc.), plus other curriculum features that might have a strong impact on student performance.

There are two basic methods by which educational policy might be developed: either from the advice of opinion-based experts or from sound data analysis. Often school districts or state departments of education claim to have found and are currently using some new "magical" solution that will remedy all their educations problems, and then after several years of data analysis, quietly discard the trendy solution. Of Tennessee's 20 school district items, 4 items reflected a marginal impact on outcome while 16 did not. As the general public becomes increasingly disturbed with the many

scandals in politics, so is it becoming equally disturbed by the current state of affairs in education. Without sound data collection and data analysis, how can education hope or expect to progress to a higher level?

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Results of Kaiser Test of Variable Sampling Adequacy

20 report card variables

Elementary Outcome Level (EOL)	Middle Outcome Level (MOL)	High School Outcome Level (HOL)	System Outcome Level (SOL)

Matrix Sampling Adequacy (MSA)

	MSA	.226		.228		.230		.230
	EOL	**.34**	**MOL**	**.46**	**HOL**	**.51**	**SOL**	**.44**
1	#SCH	.31	#SCH	.27	#SCH	.28	#SCH	.30
2	ADM	.30	ADM	.27	ADM	.28	ADM	.30
3	%SA	.27	%SA	.46	%SA	.46	%SA	.36
4	%EC	.24	%EC	.38	%EC	.41	%EC	.36
5	%OC	.35	%OC	.67	%OC	.45	%OC	.64
6	%FRL	.29	%FRL	.24	%FRL	.25	%FRL	.25
7	EPP	.24	EPP	.41	EPP	.40	EPP	.34
8	CCI	.13	CCI	.10	CCI	.10	CCI	.10
9	**%ES**	**.19**	**%ES**	**.17**	**%ES**	**.16**	**%ES**	**.16**
10	**%HS**	**.17**	**%HS**	**.14**	**%HS**	**.15**	**%HS**	**.14**
11	%CL	.24	%CL	.20	%CL	.20	%CL	.20
12	APS	.28	APS	.44	APS	.46	APS	.41
13	D-HS	.18	D-HS	.15	D-HS	.16	D-HS	.16
14	D-HO	.19	D-HO	.17	D-HO	.17	D-HO	.18
15	**D-SE**	**.22**	**D-SE**	**.20**	**D-SE**	**.20**	**D-SE**	**.21**
16	**D-CA**	**.12**	**D-CA**	**.10**	**D-CA**	**.11**	**D-CA**	**.11**
17	**D-NR**	**.21**	**D-NR**	**.18**	**D-NR**	**.18**	**D-NR**	**.19**
18	**%VO**	**.14**	**%VO**	**.50**	**%VO**	**.29**	**%VO**	**.19**
19	**%SE**	**.16**	**%SE**	**.13**	**%SE**	**.14**	**%SE**	**.15**
20	%CH1	.27	%CH1	.26	%CH1	.27	%CH1	.30

Underline/bold = Tennessee Report Card Categories that did not pass the test of "Independence".

Kaiser's test of Variable Sampling Adequacy

EOL

Total matrix sampling adequacy: .57

EOL	.77
1.#SCH	.56
2. ADM	.55
3. %SA	.70
4. %EC	.51
5. %OC	.57
6. %FRL	.60
7. EPP	.41
8. CCI	.53
9. %CL	.72
10. APS	.54
11. D-HS	.50
12. D-HO	.56
13. %VO	.39
14. %SE	.51
15. %CH1	.72

MOL

Total matrix sampling adequacy: .58

MOL	.80
1.#SCH	.57
2. ADM	.55
3. %SA	.69
4. %EC	.50
5. %OC	.58
6. %FRL	.62
7. EPP	.43
8. CCI	.53
9. %CL	.72
10. APS	.57
11. D-HS	.51
12. D-HO	.54
13. %VO	.40
14. %SE	.51
15. %CH1	.71

HOL

Total matrix sampling adequacy: .57

HOL	.77
1.#SCH	.55
2. ADM	.53
3. %SA	.67
4. %EC	.52
5. %OC	.58
6. %FRL	.63
7. EPP	.42
8. CCI	.51
9. %CL	.74
10. APS	.55
11. D-HS	.49
12. D-HO	.54
13. %VO	.41
14. %SE	.52
15. %CH1	.72

SOL

Total matrix sampling adequacy: .58

SOL	.78
1.#SCH	.57
2. ADM	.55
3. %SA	.68
4. %EC	.53
5. %OC	.57
6. %FRL	.64
7. EPP	.43
8. CCI	.52
9. %CL	.74
10. APS	.57
11. D-HS	.51
12. D-HO	.55
13. %VO	.38
14. %SE	.50
15. %CH1	.73

Bartlett Test of Sphericity

EOL

DF: 135
Chi Square: 1033.854
p≤.0001

MOL

DF: 135
Chi Square: 1049.649
p≤.0001

HOL

DF: 135
Chi Square: 1033.281
p≤.0001

SOL

DF: 135
Chi Square: 1065.042
p≤.0001

Factor Analysis

Principle Component Analysis, Default Method,
Orthogonal Transformation Solution-Varimax

Elementary	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
EOL	.79	-.19	-.03	.17	.07	.25
1.#SCH	.01	.94	.09	-.02	.04	-.14
2. ADM	.01	.95	.07	-.02	.02	-.11
3. %SA	.20	-.31	-.15	.02	-.03	.66
4. %EC	.08	.03	.15	.07	.16	.87
5. %OC	-.22	-.06	.06	-.81	-.05	-.05
6. %FRL	-.56	.14	-.10	.06	.38	-.51
7. EPP	.58	.36	.04	.26	.49	-.27
8. CCI	-.10	-.09	.28	.78	-.04	.02
9. %CL	.63	-.01	.37	.00	-.05	.05
10. APS	.76	.48	.16	.22	.03	-.03
11. D-HS	-.07	-.19	-.91	-.10	-.02	-.04
12. D-HO	.27	-.03	.83	.09	-.09	.02
13. %VO	-.09	.00	-.06	-.06	.89	.18
14. %SE	-.04	-.49	.37	.06	.39	-.31
15. %CH1	-.61	-.11	-.11	.14	.40	-.34

Middle	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
MOL	.29	-.14	-.18	.82	-.07	.13
1.#SCH	-.17	.94	.09	.06	.04	-.02
2. ADM	-.14	.95	.08	.06	.02	-.02
3. %SA	.69	-.29	-.12	.12	-.03	.02
4. %EC	.86	.04	.14	.04	.19	.08
5. %OC	-.06	-.05	.04	-.25	-.04	-.80
6. %FRL	-.57	.15	-.15	-.45	.40	.08
7. EPP	-.26	.30	.08	.67	.45	.22
8. CCI	-.01	-.09	.24	-.07	-.04	.79
9. %CL	.10	-.06	.42	.60	-.08	-.03
10. APS	.01	.42	.21	.80	-.02	.17
11. D-HS	-.03	-.19	-.91	-.03	-.03	-.12
12. D-HO	.04	-.03	.86	.18	-.11	.09
13. %VO	.15	-.01	-.06	-.03	.90	-.06
14. %SE	-.32	-.50	.36	-.06	.37	.06
15. %CH1	-.39	-.08	-.16	-.55	.43	.17

High School	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
HOL	.79	-.06	-.00	.08	.26	.01
1.#SCH	-.14	.92	.10	-.04	.21	-.02
2. ADM	-.12	.93	.09	-.03	.19	-.01
3. %SA	.60	-.28	-.14	08	-.18	.33
4. %EC	.54	.06	.14	.14	-.23	.65
5. %OC	-.09	-.01	.05	-.79	-.28	-.03
6. %FRL	-.82	.11	-.17	.02	.02	.05
7. EPP	-.04	.21	.07	.16	.87	.15
8. CCI	-.09	-.08	.25	.79	-.05	-.02
9. %CL	.41	-.08	.43	-.03	.44	-.08
10. APS	.41	.38	.22	.16	.72	-.08
11. D-HS	.00	-.17	-.91	-.12	-.05	-.06
12. D-HO	.16	-.04	.86	.10	.11	-.07
13. %VO	-.30	-.09	-.08	-.09	.26	.82
14. %SE	-.39	-.53	.35	.02	.16	.11
15. %CH1	-.76	-.13	-.18	.11	-.12	.17

System	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
SOL	.83	-.13	-.10	.16	.02	.29
1.#SCH	.00	.94	.09	-.02	.04	-.14
2. ADM	.01	.95	.08	-.02	.03	-.12
3. %SA	.23	-.31	-.15	.02	-.03	.65
4. %EC	.10	.03	.14	.07	.16	.87
5. %OC	-.20	-.05	.05	-.81	-.07	-.04
6. %FRL	-.59	.14	-.11	.06	.34	-.48
7. EPP	.54	.34	.05	.27	.55	-.29
8. CCI	-.11	-.09	.27	.78	-.06	.02
9. %CL	.63	-.03	.39	.00	.01	.02
10. APS	.77	.46	.18	.22	.10	-.07
11. D-HS	-.05	-.19	-.91	-.10	-.02	-.05
12. D-HO	.25	-.02	.84	.09	-.08	.02
13. %VO	-.15	-.01	-.05	-.06	.88	.20
14. %SE	-.11	-.49	.37	.06	.37	-.29
15. %CH1	-.66	-.10	-.12	.14	.35	-.30

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Appendix D

Proportionate Variance Contributions (Orthogonal)

Elementary Outcome Level (EOL)

Factor	%	<sum>
1	22.8%	23%
2	21.2%	44%
3	16.2%	60%
4	11.9%	72%
5	12.6%	85%
6	15.3%	100%

Middle Outcome Level (MOL)

Factor	%	<sum>
1	16.3%	16%
2	20.1%	36%
3	17.1%	54%
4	22.3%	76%
5	12.7%	89%
6	11.5%	100%

High Outcome Level (HOL)

Factor	%	<sum>
1	26.1%	26%
2	19.3%	45%
3	17.3%	63%
4	11.3%	74%
5	15.5%	90%
6	10.6%	100%

System Outcome Level (SOL)

Factor	%	<sum>
1	23.9%	24%
2	20.6%	45%
3	16.4%	61%
4	11.8%	73%
5	12.3%	85%
6	14.9%	100%

Variable Complexity-Orthotran/Varimax

EOL

Orthogonal	
EOL	1.45
1.#SCH	1.07
2. ADM	1.04
3. %SA	1.77
4. %EC	1.16
5. %OC	1.18
6. %FRL	**3.02**
7. EPP	**3.67**
8. CCI	1.33
9. %CL	1.65
10. APS	2.00
11. D-HS	1.13
12. D-HO	1.27
13. %VO	1.12
14. %SE	**3.66**
15. %CH1	**2.70**
Average	**1.83**

MOL

Orthogonal	
MOL	1.48
1.#SCH	1.10
2. ADM	1.07
3. %SA	1.50
4. %EC	1.18
5. %OC	1.22
6. %FRL	**3.17**
7. EPP	**2.88**
8. CCI	1.24
9. %CL	1.93
10. APS	1.79
11. D-HS	1.12
12. D-HO	1.15
13. %VO	1.08
14. %SE	**3.64**
15. %CH1	**3.25**
Average	**1.80**

HOL

Orthogonal	
HOL	1.25
1.#SCH	1.18
2. ADM	1.14
3. %SA	2.45
4. %EC	2.46
5. %OC	1.29
6. %FRL	1.13
7. EPP	1.28
8. CCI	1.26
9. %CL	**3.14**
10. APS	**2.59**
11. D-HS	1.12
12. D-HO	1.15
13. %VO	1.58
14. %SE	**2.98**
15. %CH1	1.39
Average	**1.71**

SOL

Orthogonal	
SOL	1.42
1.#SCH	1.07
2. ADM	1.04
3. %SA	1.84
4. %EC	1.16
5. %OC	1.16
6. %FRL	**2.84**
7. EPP	**3.72**
8. CCI	1.32
9. %CL	1.68
10. APS	2.03
11. D-HS	1.13
12. D-HO	1.22
13. %VO	1.18
14. %SE	**3.69**
15. %CH1	2.26
Average	**1.80**

Pearson Product Moment Correlation

Independent Variables	Dependent Variables				Independent Variables														
	EOL	MOL	HOL	SOL	1.#SCH	2. ADM	3. %SA	4. %EC	5. %OC	6. %FRL	7. EPP	8. CCI	9. %CL	10. APS	11. D-HS	12. D-HO	13. %VO	14. %SE	15. %CH1
EOL	1.00	.78	.62	.91	-.15	-.15	.38	.29	-.28	-.51	.35	.07	.40	.44	-.04	.23	-.01	.04	-.45
MOL	.78	1.00	.66	.92	-.12	-.11	.35	.27	-.27	-.49	.39	.05	.41	.53	.10	.05	-.06	-.13	-.51
HOL	.62	.66	1.00	.84	-.09	-.09	.46	.37	-.15	-.53	.19	-.01	.32	.43	.00	.13	-.20	-.18	-.55
SOL	.91	.92	.84	1.00	-.14	-.13	.44	.34	-.26	-.57	.36	.04	.43	.52	.02	.16	-.09	-.09	-.56
1.#SCH	-.15	-.12	-.09	-.14	1.00	.99	-.32	-.12	-.03	.19	.34	-.05	.03	.41	-.21	.04	-.01	-.24	-.07
2. ADM	-.15	-.11	-.09	-.13	.99	1.00	-.30	-.10	-.03	.17	.32	-.06	.03	.42	-.20	.02	-.02	-.27	-.08
3. %SA	.38	.35	.46	.44	-.32	-.30	1.00	.40	-.10	-.38	-.20	-.06	.17	-.04	.15	.03	.01	-.08	-.18
4. %EC	.29	.27	.37	.34	-.12	-.10	.40	1.00	-.05	-.38	-.01	.11	.14	.11	-.17	.08	.18	-.13	-.31
5. %OC	-.28	-.27	-.15	-.26	-.03	-.03	-.10	-.05	1.00	.09	-.27	-.33	-.17	-.32	.10	-.16	-.04	.05	-.05
6. %FRL	-.51	-.49	-.53	-.57	.19	.17	-.38	-.38	.09	1.00	.10	.01	-.32	-.35	.11	-.24	.20	.15	.69
7. EPP	.35	.39	.19	.36	.34	.32	-.20	-.01	-.27	.10	1.00	.13	.23	.73	-.18	.17	.26	.06	-.09
8. CCI	.07	.05	-.01	.04	-.05	-.06	-.06	.11	-.33	.01	.13	1.00	.04	.10	-.22	.17	-.06	.25	-.01
9. %CL	.40	.41	.32	.43	.03	.03	.17	.14	-.17	-.32	.23	.04	1.00	.50	-.34	.42	-.09	.00	-.33
10. APS	.44	.53	.43	.52	.41	.42	-.04	.11	-.32	-.35	.73	.10	.50	1.00	-.34	.30	-.08	-.20	-.45
11. D-HS	-.04	.10	.00	.02	-.21	-.20	.15	-.17	.10	.11	-.18	-.22	-.34	-.34	1.00	-.75	.05	-.17	.10
12. D-HO	.23	.05	.13	.16	.04	.02	.03	.08	-.16	-.24	.17	.17	.42	.30	-.75	1.00	-.13	.15	-.23
13. %VO	-.01	-.06	-.20	-.09	-.01	-.02	.01	.18	-.04	.20	.26	-.06	-.09	-.08	.05	-.13	1.00	.21	.28
14. %SE	.04	-.13	-.18	-.09	-.24	-.27	-.08	-.13	.05	.15	.06	.25	.00	-.20	-.17	.15	.21	1.00	.17
15. %CH1	-.45	-.51	-.55	-.56	-.07	-.08	-.18	-.31	-.05	.69	-.09	-.01	-.33	-.45	.10	-.23	.28	.17	1.00

Box = Significant at the p≤.05 level.
Shade = negative correlation.

Pearson Product Moment correlation

Elementary Outcome Level (EOL)

	EOL	"r"	"r^r"
1	#SCH	-.151	2.3%
2	ADM	-.148	2.2%
3	%SA	.383	14.7%
4	%EC	.285	8.1%
5	%OC	-.277	7.7%
6	**%FRL**	-.508	**25.8%**
7	EPP	.352	12.4%
8	CCI	.068	0.5%
9	**%CL**	.402	**16.2%**
10	**APS**	.438	**19.2%**
11	D-HS	-.039	0.2%
12	D-SE	.229	5.2%
13	%VO	-.006	0.0%
14	%SE	.041	0.2%
15	**%CH1**	-.454	**20.6%**
	Total		**135.1%**

Middle Outcome Level MOL

	MOL	"r"	"r^r"
1	#SCH	-.117	1.4%
2	ADM	-.110	1.2%
3	%SA	.350	12.3%
4	%EC	.265	7.0%
5	%OC	-.269	7.2%
6	**%FRL**	-.488	**23.8%**
7	**EPP**	.394	**15.5%**
8	CCI	.045	0.2%
9	**%CL**	.408	**16.6%**
10	**APS**	.529	**28.0%**
11	D-HS	.100	1.0%
12	D-SE	.050	0.3%
13	%VO	-.059	0.3%
14	%SE	-.128	1.6%
15	**%CH1**	-.507	**25.7%**
			142.2%

High School Outcome Level HOL

	MOL	"r"	"r^r"
1	#SCH	-.085	0.7%
2	ADM	-.086	0.7%
3	**%SA**	.458	**21.0%**
4	%EC	.365	13.3%
5	%OC	-.147	2.2%
6	**%FRL**	-.533	**28.4%**
7	EPP	.191	3.6%
8	CCI	-.009	0.0%
9	%CL	.316	10.0%
10	**APS**	.432	**18.7%**
11	D-HS	-.002	0.0%
12	D-SE	.128	1.6%
13	%VO	-.196	3.8%
14	%SE	-.180	3.2%
15	**%CH1**	-.545	**29.7%**
			137.1%

System Outcome Level SOL

	SOL	"r"	"r^r"
1	#SCH	-.135	1.8%
2	ADM	-.132	1.7%
3	**%SA**	.443	**19.6%**
4	%EC	.339	11.5%
5	%OC	-.264	7.0%
6	**%FRL**	-.571	**32.6%**
7	EPP	.356	12.7%
8	CCI	.043	0.2%
9	**%CL**	.425	**18.1%**
10	**APS**	.523	**27.4%**
11	D-HS	.019	0.0%
12	D-SE	.158	2.5%
13	%VO	-.089	0.8%
14	%SE	-.089	0.8%
15	**%CH1**	-.559	**31.2%**
			167.9%

Shade/Bold = Tennessee Report Card items with ≤15% of the variance between the item and the outcome level.

Box = Items with 15% or larger percentage of inflence between the item and the student outcome level.

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Multiple Regression

Model Summary (Type III Sums of Squares)

	Elementary Outcome Level	Middle Outcome Level	High Outcome Level	System Outcome Level
Count	91	91	91	91
R	.761	.804	.759	.837
R^2	.579	.646	.576	.701
Adjusted R^2	49%	58%	49%	64%
RMS Residual	.678	.539	.541	.452

	Elementary Outcome Level				
	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	15	47.4	3.16	6.87	.0001
Error	75	34.5	0.46		
Total	90	81.9			

	Middle Outcome Level				
	df	Sum of Squares	Mean Square	F-Value	P-Value
	15	39.8	2.65	9.12	.0001
	75	21.8	0.29		
	90	61.6			

	High Outcome Level				
	df	Sum of Squares	Mean Square	F-Value	P-Value
	15	29.9	1.99	6.79	.0001
	75	22	0.29		
	90	51.9			

	System Outcome Level				
	df	Sum of Squares	Mean Square	F-Value	P-Value
	15	35.9	2.39	11.7	.0001
	75	15.3	0.2		
	90	51.2			

Model Coefficient Table (Type III Sums of Squares)

	Elementary Outcome Level			
	Beta	Std. Error	t-Test	P-Value
Intercept	-19.06	7.53	-2.53	.014
1.#SCH	-0.01	0.03	-0.39	.696
2. ADM	0.00	0.00	0.25	.801
3. %SA	0.18	0.08	2.32	.023
4. %EC	0.01	0.01	0.48	.635
5. %OC	-0.05	0.03	-1.63	.108
6. %FRL	-0.02	0.01	-2.44	.017
7. EPP	0.00	0.00	3.08	.003
8. CCI	0.00	0.00	-0.52	.603
9. %CL	0.03	0.02	1.58	.118
10. APS	0.00	0.00	-0.88	.379
11. D-HS	0.02	0.02	0.90	.372
12. D-HO	0.01	0.02	0.48	.630
13. %VO	-0.01	0.01	-0.79	.431
14. %SE	0.03	0.03	1.05	.295
15. %CH1	-0.02	0.02	-1.28	.205

	Middle Outcome Level			
	Beta	Std. Error	t-Test	P-Value
	-15.97	5.99	-2.67	.009
	0.00	0.02	0.03	.980
	0.00	0.00	-0.35	.725
	0.13	0.06	2.16	.034
	0.00	0.01	0.43	.668
	-0.03	0.02	-1.46	.148
	-0.01	0.01	-1.32	.192
	0.00	0.00	2.58	.012
	0.00	0.00	-0.13	.900
	0.03	0.02	1.96	.053
	0.00	0.00	0.48	.635
	0.02	0.02	1.21	.230
	-0.02	0.02	-1.09	.281
	-0.01	0.01	-0.88	.380
	-0.01	0.02	-0.33	.745
	-0.03	0.01	-2.19	.032

	High Outcome Level			
	Beta	Std. Error	t-Test	P-Value
	-21.87	6.01	-3.64	.001
	0.04	0.02	1.87	.066
	0.00	0.00	-2.04	.045
	0.21	0.06	3.44	.001
	0.01	0.01	1.66	.101
	-0.01	0.02	-0.42	.678
	0.00	0.01	-0.44	.663
	0.00	0.00	0.56	.577
	0.00	0.00	-0.69	.495
	0.00	0.02	-0.10	.919
	0.00	0.00	1.44	.155
	0.01	0.02	0.35	.728
	-0.01	0.02	-0.56	.578
	-0.01	0.01	-1.89	.063
	0.00	0.02	-0.14	.887
	-0.02	0.01	-1.92	.059

	System Outcome Level			
	Beta	Std. Error	t-Test	P-Value
	-18.94	5.02	-3.78	.000
	0.01	0.02	0.56	.575
	0.00	0.00	-0.83	.407
	0.18	0.05	3.39	.001
	0.01	0.01	1.07	.289
	-0.03	0.02	-1.56	.123
	-0.01	0.01	-1.92	.059
	0.00	0.00	2.79	.007
	0.00	0.00	-0.58	.565
	0.02	0.01	1.54	.128
	0.00	0.00	0.33	.746
	0.01	0.01	1.07	.290
	-0.01	0.01	-0.42	.674
	-0.01	0.01	-1.50	.138
	0.01	0.02	0.35	.727
	-0.02	0.01	-2.28	.026

Comparison Among the Results of Guttman's Partial Correlation, Forward Stepwise Regression, and Multiple Regression Analyses Using 15 Tennessee Report Card Categories

Elemantary Outcome Level (EOL)	Middle Outcome Level (MOL)	High Outcome Level (HOL)	System Outcome Level SOL

Guttman's Partial Correlation

(Using 15 Variables)

	Total=	39.6%	Total=	35.9%	Total=	40.9%	Total=	48.2%
1	**EPP**	**11.2%** **	**EPP**	**8.1%** **	**%SA**	**13.6%** **	**%SA**	**13.3%** **
2	**%FRL**	**7.3%**	**%CH1**	**6.0%**	ADM	5.3%	**EPP**	**9.4%**
3	**%SA**	**6.7%**	**%SA**	**5.9%**	**%CH1**	**4.7%**	**%CH1**	**6.5%**
4	%OC	3.4%	%CL	4.9%	%VO	4.5%	**%FRL**	**4.7%**
5	%CL	3.2%	%OC	2.8%	#SCH	4.5%	%OC	3.1%
6	%CH1	2.1%	%FRL	2.3%	%EC	3.5%	%CL	3.1%
7	%SE	1.5%	D-HS	1.9%	**APS**	**2.7%**	%VO	2.9%
8	D-HO	1.1%	D-HO	1.5%	*Sum*	*38.8%* *	%EC	1.5%
9	APS	1.0%	%VO	1.0%			D-HS	1.5%
	Sum	*37.5%* *	*Sum*	*34.4%* *			ADM	0.9%
							Sum	*46.9%* *

Stepwise Regression (Forward)

(p≤.05)

(Using 15 Variables)

	Adjusted ***		Adjusted ***		Adjusted ***		Adjusted ***
	R^2	**R^2**	*R^2*	**R^2**	*R^2*	**R^2**	*R^2*	**R^2**
	50.2%	**48.5%**	*60.6%*	**57.8%**	*49.9%*	**48.2%**	*63.2%*	**61.5%**
1	**%FRL**	*25.0%*	APS	*27.2%*	**%CH1**	*28.9%*	**%FRL**	*31.9%*
2	**EPP**	*41.1%*	**%SA**	*40.3%*	**%SA**	*41.8%*	**EPP**	*53.8%*
3	**%SA**	*48.5%*	ADM	*46.9%*	APS	*48.2%*	**%SA**	*59.2%*
4			**%CH1**	*52.5%*			**%CH1**	*61.5%*
5			EPP	*56.2%*			ADM	*63.3%*

Multiple Regression

(p≤.05)

(Using 15 Variables)

	Adjusted ***		Adjusted ***		Adjusted ***		Adjusted ***
	R^2	**R^2**	*R^2*	**R^2**	*R^2*	**R^2**	*R^2*	**R^2**
	57.9%	**49.4%**	*64.6%*	**57.5%**	*57.6%*	**49.1%**	*70.1%*	**64.1%**

Difference in R^2 between the methods of caculating the percentage of influence in the 15 Report Card categories

MINIMUM (R^2)	39.6%	35.9%	40.9%	48.2%
MAXIMUM (R^2)	49.4%	57.8%	49.1%	64.1%
DIFFERENCE	**9.8%**	**21.9%**	**8.2%**	**15.9%**

* All 15 variables treated in this study constitute the basis for the percentages reported. However, only those variables exerting one percent (1%) influence or more are included.

** **Bold Categories** = Categories that were identified as having a significant (p≤.05) influence on student outcome using Stepwise Regression *(i.e., Forward)* analysis, and that were identified to have ≥ 5% influence on outcome using Guttman's partial correlation analysis.

*** Unbiased Estimate (*see Stepwise Regression and Multiple Regression*).

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